



NASA ASTROBIOLOGY INSTITUTE ANNUAL REPORT YEAR [July 2003 - June 2004]

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Annual Reports :: Year 6 :: Pennsylvania State University

Project Report: Evolution of a Habitable Planet (Kump)

Project Investigator:

Lee Kump

Project Progress

We have initiated our study of Fayetteville, Green Lake, a meromictic lake in New York State, as a modern analogue of the Proterozoic ocean. We are collecting data on water-column structure, nutrient and trace metal profiles, microbial diversity, water-column pigment distributions, and their transformation into biomarkers in the sediment.

Theoretical work has focused on the onset and behavior of anoxic oceans (with application to the Precambrian and certain intervals of the Phanerozoic). We find that the chemocline separating deep anoxic and sulfidic waters from oxygenated surface waters is subject to collapse, especially under the lowered atmospheric oxygen concentrations of the Precambrian.

Highlights

- The development of sulfidic surface waters during critical intervals in Earth history, including the mid-Cretaceous, latest Permian, late Devonian, and much of the Proterozoic, is a possible mechanism for mass extinction. Persistent hydrogen sulfide in the Proterozoic atmosphere may have delayed the colonization of the land surface.

Roadmap Objectives

- **Objective No. 1.1:** Models of formation and evolution of habitable planets
- **Objective No. 4.1:** Earth's early biosphere
- **Objective No. 6.1:** Environmental changes and the cycling of elements by the biota, communities, and ecosystems

Field Expeditions

Field Trip Name: Fayetteville Green Lake as a Proterozoic Ocean Analogue

Start Date: October, 2003	End Date: ongoing
Continent: North America	Country: United States
State/Province: New York	Nearest City/Town: Syracuse
Latitude:	Longitude:
Name of site(cave, mine, e.g.): Green Lakes State Park	Keywords: cyanobacteria calcification meromictic sulfur bacteria

Description of Work: Ongoing investigation of the chemical, physical, and biological interactions within this microbially dominated aquatic ecosystem. This stratified lake supports a diverse anaerobic ecosystem in its chemocline. The oxic surface waters promote biocalcification in the water column and the formation of "stromatolites" on the lake margins.

Members Involved: